**Citation:**

Song WO, Chun OK, Obayashi S, Cho S, Chung CE. Is consumption of breakfast associated with body mass index in US adults? *J Am Diet Assoc* 2005;105:1373-82.

**Study Design:**

cross-sectional

**Class:**

D - Click here for explanation of classification scheme.

**Research Design and Implementation Rating:**

POSITIVE: See Research Design and Implementation Criteria Checklist below.

**Research Purpose:**

To test the hypothesis that breakfast consumption is associated with weight status measure by body mass index in US Adults.

**Inclusion Criteria:**

Participants in NHANES 1999-2000 ≥ 19 years of age.

**Exclusion Criteria:**

- Pregnant or lactating women.
- Participants with unreliable dietary recall records (reference was made to an NCHS reference but details were not included).

**Description of Study Protocol:**

**Recruitment** That used in NHANES 1999-2000, not detailed

**Design** Cross-sectional comparison between breakfast consumers and non-conumers and among breakfast consumers, RTEC breakfast consumers and non-RTEC breakfast consumers and the effect of breakfast habits on BMI.

**Blinding used** NA

**Intervention** NA

**Statistical Analysis** T-tests and linear regressional analyses were performed to develop multiple logistic models. The reference groups (OR=1.0) were breakfast non-consumers and non-RTEC breakfast consumers with the logistic regressions assessing the predictability of breakfast consumption on BMI≥ 25, and the predictability of RTEC consumption on BMI ≥ 25, respectively.

**Data Collection Summary:**

**Timing of Measurements** cross-sectional

**Dependent Variables** BMI

**Independent Variables**

- breakfast consumption
- RTEC breakfast consumption

**Control Variables**

- age
- sex
- ethnicity
- smoking habit
- energy intake
- weight control

**Description of Actual Data Sample:**

**Initial N**: gg65

**Attrition (final N):** 4,218 (2,097 men and 2,121 women)

**Age**:

- 19-29 years old 825
- 30-39 years old 644
- 40-49 years old 684
- 50-59 years old 528
- 60-69 years old 735
- 70+ years old 802

**Ethnicity**:

- White 1,841
- African American 827
- Hispanic 1,170
- Others 380

**Other relevant demographics**: None

**Anthropometrics** Sample was divided on BMI ranging between BMI < 18.5 to BMI ≥30.

**Location**: U.S.

**Summary of Results:**

- Mean daily energy intake was higher for breakfast consumers than for breakfast nonconsumers among women (1871 vs 1657 kcal/d; P=.0009), but not among men.
- Compared with female breakfast nonconsumers, women who consumed breakfast were less

likely to have BMI ≥ 25 (OR=0.76, 95% CI=0.56 to 1.011 P=0.57) after adjusting for age, ethnicity, smoking, energy intake, exercise, and weight control.
- A lower prevalence of BMI ≥ 25 was consistently observed among women RTEC breakfast consumers (OR=0.70, 95% CI=0.52 to 0.94; P<.05) after adjustment for age, ethnicity, smoking, and energy intake.
- When RTEC breakfast consumption was added as a covariate, the OR for BMI ≥25 among breakfast consumers no longer differed significantly from that among breakfast nonconsumers.
- There was an inverse association between RTEC breakfast consumption and BMI in women (regression coefficient = -1.37; P<.01), but not in men.

**Other Findings**

- Breakfast consumption was highest among whites (80.4%), compared with 68.6% for African Americans, and 71.7% for Hispanics.
- RTEC breakfast consumption was highest among white (24.7%), compared with 16.1% among African Americans and 11.1% among Hispanics.
- Breakfast consumers, compared to nonconsumers, were more likely to be trying to control their weight (10.8% vs. 6.3%, P<.01).
- Energy intake from fat was not significantly different between breakfast consumers and non-consumers (33% vs. 32%). Among men and women, breakfast consumers had significantly higher dietary fiber intake than breakfast non-consumers (17±0.3g vs. 12±0.4g) and RTEC breakfast consumers also had significantly higher dietary fiber intake than non-RTEC breakfast consumers (P<0.001 for both comparisons).

**Author Conclusion:**

This study demonstrates a relationship between RTEC breakfast consumption and BMI <25 in women. After adding RTEC consumption as a covariate in adition to age, ethnicity, smoking, energy intake, exercise habits, and weight control, the OR for BMI ≥ 25 among breakfast consumers was no longer significantly different from that for breakfast nonconsumers. A similar tendency was observed in multiple linear regression models on the relationship between RTEC breakfast consumption and BMI. These results supported the previous assumption that RTEC breakfast consumption may play an important role in the effectiveness of breakfast consumption in weight regulation. This is consistent with findings of others who reported that RTEC breakfast consumers tend to be leaner, and frequent RTEC consumers have lower mean BMI across age and sex than breakfast nonconsumers or breakfast consumers who eat other types of breakfast foods. Sex difference in the association of breakfast consumption and RTEC breakfast consumption with lower prevalence of overweight needs further studies.

***Reviewer Comments:***

*Although cross-sectional in nature, this paper provides further evidence that breakfast consumption is related to body weight. In women, breakfast consumption was positively related to total energy intake but inversely related to BMI. Similarly, RTEC breakfast consumption was inversely related to BMI in women. This suggests that breakfast consumption (and particularly RTEC consumption) leads to a healthier body weight in women. However, none of these relationships were found in men and, although the sample was quite diverse ethnically, none of the regression analyses looked at how ethnicities might differ. Future studies which address the issues of how gender and ethnicity affect the relationship between breakfast intake and body weight will be important.*

*Research Design and Implementation Criteria Checklist: Primary Research*

| Relevance Questions | | |
|---|---|---|
| 1. | Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies) | Yes |
| 2. | Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about? | Yes |
| 3. | Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice? | Yes |
| 4. | Is the intervention or procedure feasible? (NA for some epidemiological studies) | Yes |

| Validity Questions | | |
|---|---|---|
| **1.** | **Was the research question clearly stated?** | Yes |
| 1.1. | Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified? | Yes |
| 1.2. | Was (were) the outcome(s) [dependent variable(s)] clearly indicated? | Yes |
| 1.3. | Were the target population and setting specified? | Yes |
| **2.** | **Was the selection of study subjects/patients free from bias?** | Yes |
| 2.1. | Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study? | Yes |
| 2.2. | Were criteria applied equally to all study groups? | Yes |
| 2.3. | Were health, demographics, and other characteristics of subjects described? | Yes |
| 2.4. | Were the subjects/patients a representative sample of the relevant population? | Yes |
| **3.** | **Were study groups comparable?** | Yes |
| 3.1. | Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT) | N/A |
| 3.2. | Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline? | N/A |
| 3.3. | Were concurrent controls used? (Concurrent preferred over historical controls.) | N/A |

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| 3.4. | If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis? | Yes |
| 3.5. | If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.) | Yes |
| 3.6. | If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")? | N/A |
| **4.** | **Was method of handling withdrawals described?** | N/A |
| 4.1. | Were follow-up methods described and the same for all groups? | N/A |
| 4.2. | Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.) | N/A |
| 4.3. | Were all enrolled subjects/patients (in the original sample) accounted for? | N/A |
| 4.4. | Were reasons for withdrawals similar across groups? | N/A |
| 4.5. | If diagnostic test, was decision to perform reference test not dependent on results of test under study? | N/A |
| **5.** | **Was blinding used to prevent introduction of bias?** | N/A |
| 5.1. | In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate? | N/A |
| 5.2. | Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.) | N/A |
| 5.3. | In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded? | N/A |
| 5.4. | In case control study, was case definition explicit and case ascertainment not influenced by exposure status? | N/A |
| 5.5. | In diagnostic study, were test results blinded to patient history and other test results? | N/A |
| **6.** | **Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?** | N/A |
| 6.1. | In RCT or other intervention trial, were protocols described for all regimens studied? | N/A |
| 6.2. | In observational study, were interventions, study settings, and clinicians/provider described? | Yes |

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| 6.3. | Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect? | Yes |
| 6.4. | Was the amount of exposure and, if relevant, subject/patient compliance measured? | N/A |
| 6.5. | Were co-interventions (e.g., ancillary treatments, other therapies) described? | N/A |
| 6.6. | Were extra or unplanned treatments described? | N/A |
| 6.7. | Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups? | N/A |
| 6.8. | In diagnostic study, were details of test administration and replication sufficient? | N/A |
| **7.** | **Were outcomes clearly defined and the measurements valid and reliable?** | Yes |
| 7.1. | Were primary and secondary endpoints described and relevant to the question? | Yes |
| 7.2. | Were nutrition measures appropriate to question and outcomes of concern? | Yes |
| 7.3. | Was the period of follow-up long enough for important outcome(s) to occur? | Yes |
| 7.4. | Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures? | Yes |
| 7.5. | Was the measurement of effect at an appropriate level of precision? | Yes |
| 7.6. | Were other factors accounted for (measured) that could affect outcomes? | Yes |
| 7.7. | Were the measurements conducted consistently across groups? | Yes |
| **8.** | **Was the statistical analysis appropriate for the study design and type of outcome indicators?** | Yes |
| 8.1. | Were statistical analyses adequately described and the results reported appropriately? | Yes |
| 8.2. | Were correct statistical tests used and assumptions of test not violated? | Yes |
| 8.3. | Were statistics reported with levels of significance and/or confidence intervals? | Yes |
| 8.4. | Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)? | N/A |
| 8.5. | Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)? | Yes |
| 8.6. | Was clinical significance as well as statistical significance reported? | Yes |

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| 8.7. | If negative findings, was a power calculation reported to address type 2 error? | N/A |
| **9.** | **Are conclusions supported by results with biases and limitations taken into consideration?** | Yes |
| 9.1. | Is there a discussion of findings? | Yes |
| 9.2. | Are biases and study limitations identified and discussed? | Yes |
| **10.** | **Is bias due to study's funding or sponsorship unlikely?** | Yes |
| 10.1. | Were sources of funding and investigators' affiliations described? | Yes |
| 10.2. | Was the study free from apparent conflict of interest? | Yes |